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MISCELLANEOUS.

104. Proposed by HARRY S. VANDIVER, Bala, Pa.

A Theorem of Fermat. The area of a right angled triangle with commensurable sides cannot be a square number. [Cf. Chrystal's *Algebra*, Vol. II., page 535.]

Solution by L. C. WALKER, A. M., Professor of Mathematics, Petaluma High School, Petaluma, Cal.

Since the sides of the right-angled triangle may have a common factor, we let af, bf, and cf represent its sides, where a, b, c are prime to each other. Then we have $a^2+b^2=c^2$......(1).

For the area, $\frac{1}{2}abf^2$, of the triangle to be a square, $\frac{1}{2}ab$ must be a square.

In (1) either a or b must be even and the other odd, because the sum of two odd squares can not be a square. Assume a even and b odd. Then for $\frac{1}{2}ab$ to be a square, b must be a square, and a must be double a square.

Let $a=2m^2$, $b=n^2$, and substitute these values in (1); then we have

$$(2m^2)^2+(n^2)^2=c^2\text{......}(2).$$

Now set $2m^2=2pq$, and $n^2=p^2-q^2$; or

$$n^2+q^2=p^2\text{......}(3).$$

In (3) p is odd, and we will assume q even. Let $q=2\alpha\beta$, $p=\alpha^2+\beta^2$, and we find $m=2\alpha\beta(\alpha^2+\beta^2)$......(4).

For $2\alpha\beta$ to be a square, we will assume $\alpha=2m_1^2$ and $\beta=n_1^2$. Substituting these values in (4), we obtain

$$m^2=4m_1^2n_1^2(4m_1^4+n_1^4)\text{......}(5).$$

In order that the right member of (5) may be a square, we must have

$$4m_1^4+n_1^4=c_1^2,$$

say; which is of the same form of (2). But c_1^2 is less than c^2. Proceeding in exactly the same way, we can reduce c^2 indefinitely. By our hypothesis c^2 can not be reduced to zero nor less. Hence, results *Fermat's Theorem.*

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PROBLEMS FOR SOLUTION.

ARITHMETIC.

154. Proposed by J. SCHEFFER, A. M., Hagerstown, Md.

Suppose there is a meadow of 8 acres in which the grass grows uniformly, and that 21 oxen could eat up the whole pasture in 6 weeks, or 18 oxen in 9 weeks; what number of oxen diminished by the removal of 9, at the end of 14 weeks, could eat it up in 18 weeks ?

155. Proposed by **F. P. MATZ. Sc. D.. Ph. D.**, Professor of Mathematics and Astronomy in Defiance College, Defiance. O.

A bought a horse, which he sold to B at a *loss* of $m=6\%$; B sold the horse to C at a *loss* of $n=5\%$; and C sold the horse to D at a *gain* of $p=12\frac{1}{2}\%$. How much did A *lose*, if C gained $\$G=\$26.79$?

ALGEBRA.

156. Proposed by **B. F. FINKEL. A. M., M. Sc.**. Professor of Mathematics and Physics in Drury College, Springfield, Mo.

$(z+x)a-(z-x)b=2yz$......(1); $(x+y)b-(x-y)c=2xz$......(2); $(y+z)c-(y-z)a=2xy$......(3). Find the values of x, y, and z, by the method of linear simultaneous equations.

NOTE. This problem was somewhat abbreviated in the last issue. The problem occurs in Fisher & Schwatt's *Elements of Algebra*, page 224, under Linear Simultaneous Equations.

157. Proposed by **G. B. M. ZERR, A. M., Ph. D.**, Professor of Chemistry and Physics in The Temple College, Philadelphia. Pa.

Solve the equations,

$$\frac{x}{a+\lambda}+\frac{y}{b+\lambda}+\frac{z}{c+\lambda}+\frac{u}{d+\lambda}=1,\qquad \frac{x}{a+\mu}+\frac{y}{b+\mu}+\frac{z}{c+\mu}+\frac{u}{d+\mu}=1,$$

$$\frac{x}{a+\nu}+\frac{y}{b+\nu}+\frac{z}{c+\nu}+\frac{u}{d+\nu}=1,\qquad \frac{x}{a+\rho}+\frac{y}{b+\rho}+\frac{z}{c+\rho}+\frac{u}{d+\rho}=1.$$

158. Proposed by **R. D. BOHANNON, Ph. D.**. Professor of Mathematics, Ohio State University, Columbus, O.

$$\text{If } \frac{x}{a+\alpha}+\frac{y}{b+\alpha}+\frac{z}{c+\alpha}=\frac{x}{a+\beta}+\frac{y}{b+\beta}+\frac{z}{c+\beta}=\frac{x}{a+\gamma}+\frac{y}{b+\gamma}+\frac{z}{c+\gamma}=1,$$

$$\text{show, } \frac{x}{(a+\beta)^2}+\frac{y}{(b+\beta)^2}+\frac{z}{(c+\beta)^2}=\frac{(\gamma-\beta)(\alpha-\beta)}{(a+\beta)(b+\beta)(c+\beta)}.$$

GEOMETRY.

182. Proposed by **MARCUS BAKER, U. S.** Geological Survey, Washington, D. C.

Show how to cut from a given cube, edge s, the maximum tetrahedron.

183. Proposed by **S. F. NORRIS**, Professor of Mathematics and Astronomy, Baltimore City College, Baltimore, Md.

"Two quadrilaterals having three sides of the one equal to the three corresponding sides of the other, each to each, and the two corresponding angles adjacent to the unknown sides equal, each to each, are equal figures." [Olney's *Geometry*, page 129.]